3

Executive Summary

Water Supplies

This chapter describes how water supplies are calculated and summarized within a water budget framework. A description of California's existing supplies–surface water, groundwater, recycled water, and desalted water–and how a portion of these supplies are reallocated through water marketing follows. This chapter concludes with a review of water quality considerations that influence how the State's water supplies are used.

Water Supply Calculation

Bulletin 160-98 calculates existing water supply and demand, then balances forecasted demand against existing supply and future water management options. The balance, or water budget, with existing supply is presented on a statewide basis in Chapter ES5 and on a regional basis in Appendix ES5A. The water budget with future water management options is also presented in Chapter ES5.

Definition of Bulletin 160 Water Supplies

The SWP's California Aqueduct is the only conveyance facility that moves water from the Central Valley to Southern California.

The Bulletin 160 water budgets do not account for the State's entire water supply and use. In fact, less than one-third of the State's precipitation is quantified in the water budgets. Precipitation provides California with nearly 200 maf of total water supply in average years. Of this renewable supply, about 65 percent is depleted through evaporation and transpiration by trees and other plants. This large volume of water is excluded from the Bulletin 160 water supply

Key Water Supply and Water Use Definitions

Chapters ES3 and ES4 introduce California's water supplies and urban, agricultural, and environmental water uses. Certain key concepts, defined below, provide an essential foundation for presenting and analyzing water supplies and water use.

Applied Water: The amount of water from any source needed to meet the demand of the user. It is the quantity of water delivered to any of the following locations:

- The intake to a city water system or factory.
- The farm headgate or other point of measurement.
- A managed wetland, either directly or by drainage flows.

For instream use, applied water is the quantity of stream flow dedicated to instream use (or reserved under federal or State wild and scenic rivers legislation) or to maintaining flow and water quality in the Bay-Delta pursuant to the SWRCB's Order WR 95-6.

Net Water: The amount of water needed in a water service area to meet all demands. It is the sum of evapotranspiration of applied water in an area, the irrecoverable losses from the distribution system, and agricultural return flow or treated urban wastewater leaving the area.

Irrecoverable Losses: The amount of water lost to a salt sink, lost by evapotranspiration, or lost by evaporation from a conveyance facility, drainage canal, or fringe areas.

Evapotranspiration: ET is the amount of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces.

Evapotranspiration of Applied Water: ETAW is the portion of the total ET which is provided by applied irrigation water.

Depletion: The amount of water consumed within a service area that is no longer available as a source of supply. For agricultural and certain environmental (i.e., wetlands) water use, depletion is the sum of irrecoverable losses and the ETAW due to crops, wetland vegetation, and flooded water surfaces. For urban water use, depletion is the ETAW due to landscaping and gardens, wastewater effluent that flows to a salt sink, and incidental ET losses. For environmental instream use, depletion is the amount of dedicated flow that proceeds to a salt sink.

and water use calculations. The remaining 35 percent stays in the State's hydrologic system as runoff. (Figure ES3-1.)

Over 30 percent of the State's runoff is not explicitly designated for urban, agricultural, or environmental uses. This water is depleted from the State's hydrologic system as outflow to the Pacific Ocean or other salt sinks. (Some of this non-designated runoff is captured by reservoirs, but is later released for flood control.) Similar to precipitation depletions by vegetation, non-designated runoff is excluded from the Bulletin 160 water supply and water use calculations.

The State's remaining runoff is available as renewable water supply for urban, agricultural, and environmental uses in the Bulletin 160 water budgets. In addition to this supply, Bulletin 160 water budgets include a few supplies that are not generated by intrastate precipitation. These supplies include imports from the Colorado and Klamath Rivers and new supplies generated by water recycling and desalting.

Applied Water Methodology

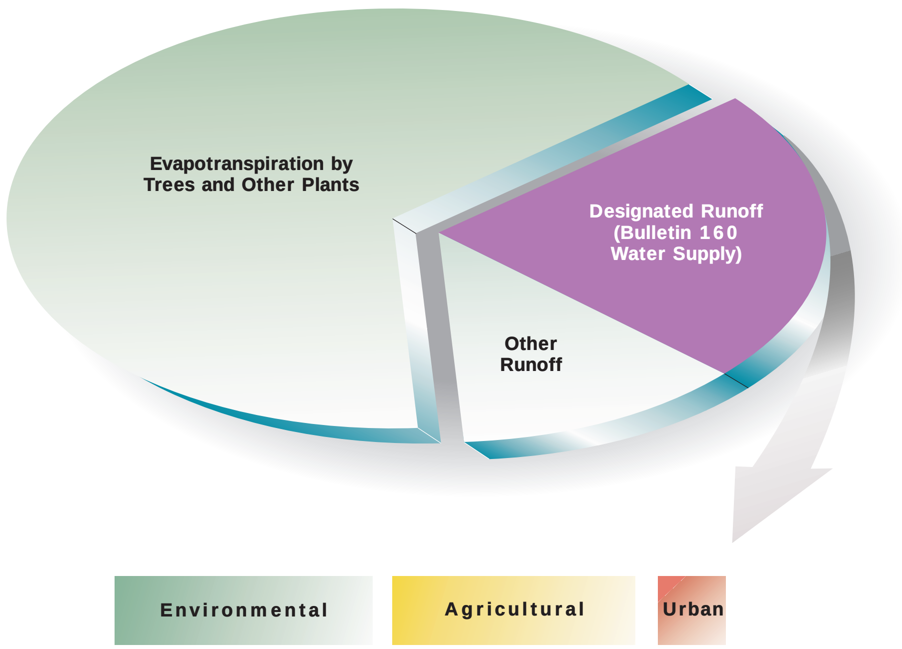
Bulletin 160-98 water supplies are computed using applied water data. As defined in the sidebar, applied water refers to the amount of water from any source employed to meet the demand of the user. Previous editions of Bulletin 160 computed water supplies using net water data. Bulletin 160-98 switched from a net water methodology to an applied water methodology in response to public comments on Bulletin 160-93. Because applied water data are analogous to agency water delivery data, water supply data based on an applied water methodology are easier for local water agencies to review. Net water supply values are smaller than applied water supply values because they exclude that portion of demand met by reapplication of surface and groundwater supplies.

Reapplication can be a significant source of water in many hydrologic regions of California. An applied water budget explicitly accounts for this source. However, because of reapplication, applied water budgets do not translate directly into the supply of water needed to meet future demands. The approach used to compute the new water required to meet future demands with applied water budgets is presented in Chapter ES5.

Normalized Data

Water budget data used to represent the base planning year do not necessarily match the historical conditions observed in 1995. Instead, Bulletin 160-98's base year applied water budget data are developed

FIGURE ES3-1.
Disposition of California's Average Annual Precipitation



from "normalized" water supply, land use, and water use data. Through the normalizing process, year-to-year fluctuations caused by weather and market abnormalities are removed from the data. For example, water year 1998 would greatly underestimate average annual water use, as rainfall through May and early June provided the necessary moisture needed to meet crop and landscape water demands. In most years, much of California would require applied water supplies during May and early June. The procedures used to normalize water supply and water use data are described in the sidebar on page ES3-4.

Water Supply Scenarios

California is subject to a wide range of hydrologic conditions and water supply variability. Knowledge of water supplies under a range of hydrologic conditions is necessary to evaluate reliability needs that water managers must meet. Two water supply scenarios—average year conditions and drought year conditions—were selected from among a spectrum of possible water supply conditions to represent variability in the regional and statewide water budgets.

The average year supply scenario represents the average annual supply of a system over a long planning horizon. Average year supplies from the CVP and SWP are defined by operations studies for a base (1995) level of development and for a future (2020) level of development. Project delivery capabilities are defined over a 73-year hydrologic sequence. For other water supply projects, historical data are normalized to represent average year conditions. For required environmental flows, average year supply is estimated for each of its components. Wild and scenic river flow is calculated from long-term average unimpaired flow data. Instream flow requirements are defined for an average year under specific agreements, water rights, court decisions, and congressional directives. Bay-Delta outflow requirements are estimated from operations studies.

For many local water agencies, and especially urban agencies, drought water year supply is the critical factor in planning for water supply reliability. Traditional drought planning often uses a design drought hydrology to characterize project operations under future conditions. For a planning region with the size and hydrologic complexity of California, selecting an appropriate statewide design drought presents a challenge. The 1990-91 water years were selected to represent the drought year supply scenario for Bulletin 160-98. (The 1990-91 water years were also used to represent the drought year scenario in Bulletin 160-93.)

Procedures for Normalizing Water Supply and Water Use Data

On the supply side, normalized water project delivery values are computed by averaging historical delivery data. Normalized "average year" project supplies are typically computed from 3 to 5 recent non-deficient water years. Normalized "drought year" project supplies are computed by averaging historical delivery data from 1990 and 1991. A notable exception to the above procedure is the development of normalized CVP and SWP project deliveries. Supplies from these projects are developed from operations studies rather than from historical data. Operations studies provide an average project delivery capability over a multi-year sequence of hydrology under SWRCB Order WR 95-6 Bay-Delta standards.

On the demand side, base year urban per capita water use data are normalized to account for factors such as residual effects of the 1987-92 drought. In any given year, urban landscape and agricultural irrigation requirements will vary with precipitation, temperature, and other factors. Base year water use data are normalized to represent ETAW requirements under average and drought year water supply conditions. Land use data are also normalized. The Department collects land use data through periodic surveys; however, the entire State is not surveyed in any given year (such as 1995). To arrive at an estimate of historical statewide land use for a specific year, additional sources of data are consulted to interpolate between surveys. After a statewide historical land use base is constructed, it is evaluated to determine if it was influenced by abnormal weather or crop market conditions and is normalized to remove such influences.

Normalizing allows Bulletin 160-98 to define an existing level of development (i.e., the 1995 base year) that is compatible with a forecasted level of development (i.e., the 2020 forecast year). Future year shortage calculations implicitly rely on a comparison between future water use and existing water supply, as water supplies do not change significantly (without implementation of new facilities and programs) over the planning horizon. Therefore, the normalizing procedure is necessary to provide an appropriate future year shortage calculation. Normalizing also permits more than one water supply condition to be evaluated for a given level of development. If historical data were used to define the base year, only one specific hydrologic condition would be represented. (Historical data for 1995 would represent a wet year.) But through normalizing, a base level of development can be evaluated under a range of hydrologic conditions.

The 1990-91 drought year scenario has a recurrence interval of about 20 years, or a 5 percent probability of occurring in any given year. This is typical of the drought level used by many local agencies for routine water supply planning. For extreme events such as the 1976-77 drought, many agencies would implement shortage contingency measures such as mandatory rationing. Another important consideration in selecting water years 1990-91 was that, because of their recent occurrence, local agency water demand and supply data were readily available.

The statewide occurrence of dry conditions during the 1990-91 water years was another key consideration in selecting them as a representative drought. Because of the size of California, droughts may or may not occur simultaneously throughout the entire state.

Sources of Water Supply

Table ES3-1 shows California's estimated water supply, for average and drought years under 1995 and 2020 levels of development, with existing facilities and programs. Facility operations in the Delta are assumed to be in accordance with Order WR 95-6. The State's 1995-level average year water supply is about 77.9 maf, including about 31.4 maf of dedicated flows for environmental uses. As previously discussed, this supply is based on an applied water methodology and therefore includes considerable amounts of reapplication within hydrologic regions.

Even with a reduction in Colorado River supplies to California's 4.4 maf basic apportionment, annual average statewide supply is projected to increase about 0.2 maf by 2020 without implementation of new water supply options. While the expected increase in average year water supplies is due mainly to higher CVP and SWP deliveries (in response to higher 2020-level demands), new water production will also result from groundwater and from recycling facilities currently under construction.

The State's 1995-level drought year water supply is about 59.6 maf, of which about 16.6 maf is dedicated for environmental uses. Annual drought year supply is expected to increase slightly by 2020 without implementation of new water supply options. The expected increase would come from higher CVP

TABLE ES3-1

California Water Supplies with Existing Facilities and Programs[a] (taf)

Supply	*1995*		*2020*	
	Average	*Drought*	*Average*	*Drought*
Surface				
CVP	7,004	4,821	7,347	4,889
SWP	3,126	2,060	3,439	2,394
Other Federal Projects	910	694	912	683
Colorado River	5,176	5,227	4,400	4,400
Local Projects	11,054	8,484	11,073	8,739
Required Environmental Flow	31,372	16,643	31,372	16,643
Reapplied	6,441	5,596	6,449	5,575
Groundwater[b]	12,493	15,784	12,678	16,010
Recycled and Desalted	324	333	415	416
Total (rounded)	**77,900**	**59,640**	**78,080**	**59,750**

[a] Bulletin 160-98 presents water supply data as applied water, rather than net water. This distinction is explained in a previous section. Past editions of Bulletin 160 presented water supply data in terms of net supplies.

[b] Excludes groundwater overdraft

and SWP deliveries and new production from surface water, groundwater, and recycling facilities currently under construction.

Surface Water Supplies

Surface water includes developed supplies from the CVP, SWP, Colorado River, other federal projects, and local projects. Figure ES3-2 shows the location of the State's major water projects. Surface water also includes the supplies for required environmental flows. Required environmental flows are comprised of undeveloped supplies designated for wild and scenic rivers, supplies used for instream flow requirements, and supplies used for Bay-Delta water quality and outflow requirements. Finally, surface water includes supplies available for reapplication downstream. Urban wastewater discharges and agricultural return flows, if beneficially used downstream, are examples of reapplied surface water.

Groundwater Supplies

In an average year, about 30 percent of California's urban and agricultural applied water is provided by groundwater extraction. In drought years when surface supplies are reduced, groundwater supports an even larger percentage of use. The amount of water stored in California's aquifers is far greater than that stored in the State's surface water reservoirs, although only a portion of California's groundwater resources can be economically and practically extracted for use.

Bulletin 160-98 excludes long-term basin extractions in excess of long-term basin inflows in its definition of groundwater supply. This long-term average annual difference between extractions and recharge, defined in the Bulletin as overdraft, is not a sustainable source of water and is thus excluded from the base year and forecast year groundwater supply estimates. (In response to public comments on the Bulletin 160-93, Bulletin 160-98 is the first water plan update to exclude overdraft from the base year groundwater supply estimate.)

In wet years, recharge into developed groundwater basins tends to exceed extractions. Conversely, in dry years, groundwater basin recharge tends to be less than groundwater basin extraction. By definition, overdraft is not a measure of these annual fluctuations in groundwater storage volume. Instead, overdraft is a measure of the long-term trend associated with these annual fluctuations. The period of record used to evaluate overdraft must be long enough to produce data that, when averaged, approximate the long-term average hydrologic conditions for the basin. Table ES3-2 shows the Department's estimates of 1995 and 2020-level groundwater overdraft by hydrologic region. Within some regions, overdraft occurs in some well-defined subareas, while additional groundwater development potential may exist in other subareas.

For the 1995 base year, Bulletin 160-98 estimates a statewide increase in groundwater overdraft (160 taf) above the 1990 base year reported in Bulletin 160-93. Most of the statewide increase in overdraft occurred in the San Joaquin and Tulare Lake Regions, two regions

FIGURE ES3-2.

California's Major Water Projects

TABLE ES3-2

1995 and 2020 Level Overdraft by Hydrologic Region (taf)

	1995		*2020*	
Region	***Average***	***Drought***	***Average***	***Drought***
North Coast	0	0	0	0
San Francisco Bay	0	0	0	0
Central Coast	214	214	102	102
South Coast	0	0	0	0
Sacramento River	33	33	85	85
San Joaquin River	239	239	63	63
Tulare Lake	820	820	670	670
North Lahontan	0	0	0	0
South Lahontan	89	89	89	89
Colorado River	69	69	61	61
Total (rounded)	**1,460**	**1,460**	**1,070**	**1,070**

where surface water supplies have been reduced in recent years by Delta export restrictions, CVPIA implementation, and ESA requirements. CVP contractors in these regions who rely on Delta exports for their surface water supply have experienced supply deficiencies of up to 50 percent subsequent to implementation of export limitations and CVPIA requirements. Many of these contractors have turned to groundwater pumping for additional water supplies. This long-term increase in groundwater extractions exacerbated a short-term decline in water levels as a result of the 1987-92 drought.

As shown in Table ES3-2, groundwater overdraft is expected to decline from 1.5 maf/yr to 1.1 maf/yr statewide by 2020. Overdraft in the Central Coast Region is expected to decline as demand shifts from groundwater to imported SWP supplies, provided through the recently completed Coastal Branch of the California Aqueduct. The reduction in irrigated acreage in drainage problem areas on the west side of the San Joaquin Valley, as described in the 1990 report of the San Joaquin Valley Interagency Drainage Program, is expected to reduce groundwater demands in the San Joaquin River and Tulare Lake regions by 2020. Some increases in groundwater overdraft are expected in Sacramento, Placer, and El Dorado Counties of the Sacramento River Region.

Water Marketing

In recent years, water marketing has received increasing attention as a tool for addressing statewide imbalances between water supply and water use. Experiences with water markets during and since the 1987-92 drought bolstered interest in using marketing as a local and statewide water supply augmentation option. While water marketing does allow water agencies to purchase additional water supply reliability during both average and drought years, water marketing does not create new water. Therefore, water markets alone cannot meet California's long-term water supply needs.

In this update of the *California Water Plan*, water marketing may include:

- A permanent sale of a water right by the water right holder.
- A lease from the water right holder (who retains the water right), allowing the lessee to use the water under specified conditions over a specified period of time.
- A sale or lease of a contractual right to water supply. Under this arrangement, the ability of the holder to transfer a contractual water right is usually contingent upon receiving approval from the supplier. An example of this type of arrangement is a sale or lease by a water agency that receives its supply from the CVP, SWP, or other water wholesaler.

Water marketing is not an actual statewide source of water, but rather is a means to reallocate existing supplies. Therefore, marketing is not explicitly itemized as a source of water supply from existing facilities and programs in the Bulletin 160 water budgets. (Water marketing agreements in place by 1995 are considered to be existing programs and are implicitly part of the water budgets.) Water marketing is identified as a potential water supply augmentation option in the Bulletin 160 water budgets. Potential water marketing options have several characteristics that must

TABLE ES3-3

Recently Completed Long-Term Water Marketing Agreements

Participants	*Region(s)*
Westside Water District, Colusa County Water District	Sacramento River
Semitropic Water Storage District, Santa Clara Valley Water District	Tulare Lake, San Francisco Bay
Semitropic Water Storage District, Alameda County Water District	Tulare Lake, San Francisco Bay
Semitropic Water Storage District, Zone 7 Water Agency	Tulare Lake, San Francisco Bay
Semitropic Water Storage District, Metropolitan Water District of Southern California	Tulare Lake, South Coast
Kern County Water Agency, Mojave Water Agency	Tulare Lake, South Lahontan
Arvin-Edison Water Storage District, Metropolitan Water District of Southern California	Tulare Lake, South Coast
Mojave Water Agency, Solano County Water Agency	South Lahontan, San Francisco Bay
Imperial Irrigation District, Metropolitan Water District of Southern California	Colorado River, South Coast

be captured in the water budgets incorporating supplies from future management options. For example, through changes in place of use, water marketing options can reallocate supplies from one hydrologic region to another. And through changes in type of use, water marketing options can reallocate supplies from one water use sector to another. Finally, for a given place and type of use, water marketing options can reallocate supplies among average years and drought years.

While several long-term agreements have been completed in recent years (see Table ES3-3), short-term agreements have made up the majority of water marketing. Short-term agreements, with terms less than one year, can be an effective means of alleviating the most severe drought year impacts. Short-term agreements can be executed on the spot market; however, water purveyors are increasingly interested in negotiating longer-term agreements for drought year transfers. In such future agreements, specific water supply conditions may be the triggers to determine whether water would be transferred in a specific year.

Two examples of programs for acquiring water through short-term agreements are the Drought Water Bank and the CVPIA interim water acquisition program. Beyond these programs, data on short-term water marketing arrangements are difficult to locate and verify. Agreements executed for less than one year do not need SWRCB approval (unless there is a change in place of use or point of diversion) and thus are not tracked by outside entities. Data are also difficult to evaluate, as it is often difficult to distinguish between exchanges and marketing arrangements.

Water Recycling and Desalting Supplies

Water recycling is the intentional treatment and management of wastewater to produce water suitable for reuse. Several factors affect the amount of wastewater treatment plant effluent that local agencies are able to recycle, including the size of the available market and the seasonality of demands. Local agencies must plan their facilities based on the amount of treatment plant effluent available and the range of expected service area demands. In areas where irrigation uses constitute the majority of recycled water demands, winter and summer demands may vary greatly. (Where recycled water is used for groundwater recharge, seasonal demands are more constant throughout the year.) Also, since water recycling projects are often planned to supply certain types of customers, the proximity of these customers to each other and to available pipeline distribution systems affects the economic viability of potential recycling projects.

Technology available today allows many municipal wastewater treatment systems to produce water supplies at competitive costs. More stringent treatment requirements for disposal of municipal and industrial wastewater have reduced the incremental cost for higher levels of treatment required for recycled water. The degree of additional treatment depends on the intended use. Recycled water is used for agricultural and landscape irrigation, groundwater recharge, and industrial and environmental uses. Some uses are required to meet more stringent standards for public health protection. An example is the City of San Diego's planned 18 mgd wastewater repurification facility. This water project would produce about 16 taf/yr of repurified water to augment local municipal supplies. If implemented, the project would be California's first planned indirect potable reuse project that discharges repurified water directly into a surface reservoir.

The use of recycled water can lessen the demand for new water supply. However, not all water recycling produces new water supply. Bulletin 160 counts water that would otherwise be lost to the State's hydrologic system (i.e., water discharged directly to the ocean or to another salt sink) as recycled water supply. If water recycling creates a new demand which would not otherwise exist, or if it treats water that would have otherwise been reapplied by downstream entities or recharged to usable groundwater, it is not considered new water supply. Water recycling provides multiple benefits such as reduced wastewater discharge and improved water quality.

The Department, in coordination with the WateReuse Association of California, conducted a 1995 survey to update the Association's 1993 survey of local agencies' current and planned water recycling. By 2020, total water recycling is expected to increase from 485 taf/yr to 577 taf/yr, due to greater production at existing treatment plants and new production at plants currently under construction. This base production is expected to increase new recycled supplies from 323 taf/yr to 407 taf/yr. All new recycled water is expected to be produced in the San Francisco Bay, Central Coast, and South Coast Regions. Table ES3-4 shows future potential options for water recycling.

TABLE ES3-4

2020 Level Total Water Recycling and New Water Supply (taf)

Projects	*Total Water Recycling*	*New Water Supply*
Base	577	407
Options	835	655
Total	1,412	1,062

By 2020, water recycling options could bring total water recycling potential to over 1.4 maf/yr, potentially generating as much as 1.1 maf/yr of new supply, if water agencies implemented all projects identified in the survey.

The capacity of California's existing desalting plants totals about 66 taf annually; feedwater sources are brackish groundwater, wastewater, and seawater. Total seawater desalting capacity is currently about 8 taf/yr statewide. Most existing plants are small (less than 1 taf/yr) and have been constructed in coastal communities with limited water supplies. The Santa Barbara desalting plant, with capacity of 7.5 taf/yr, is currently the only large seawater desalting plant. The plant was constructed during the 1987-92 drought and is now on long-term standby. In the 1995-level water budget, 8 taf of seawater desalting is included as a drought year supply. In the 2020-level water budget, 8 taf of seawater desalting is included as average and drought year supplies.

Water Supply Summary by Hydrologic Region

Table ES3-5 summarizes average year water supplies by hydrologic region assuming 1995 and 2020 levels of development and existing facilities and programs. Similarly, Table ES3-6 summarizes drought year water supplies by hydrologic region for existing and future levels of development. Regional water supplies, along with water demands presented in the following chapter, provide the basis for the statewide water budget developed in Chapter ES5 and regional water budgets developed in Appendices ES5A and ES5B.

Water Quality

A critical factor in determining the usability and reliability of any particular water source is water quality. The quality of a water source will significantly affect the beneficial uses of that water. Water has many potential uses, and the water quality requirements for each use vary. Sometimes, different water uses may have conflicting water quality requirements. For example, water temperatures ideal for irrigation of some crops may not be suitable for fish spawning.

The establishment and enforcement of water quality standards for water bodies in California fall under the authority of SWRCB and the nine regional water quality control boards. The RWQCBs protect water quality through adoption of region-specific water quality control plans, commonly known as basin plans. In general, water quality control plans designate beneficial uses of water and establish water quality objectives designed to protect them. The designated beneficial uses of water may vary between individual water bodies.

Water quality objectives are the limits or levels of water quality constituents or characteristics which are established to protect beneficial uses. Because a particular water body may have several beneficial uses, the water quality objectives established must be protective of all designated uses. When setting water quality objectives, several sources of existing water quality limits are used, depending on the uses designated in a water quality control plan. When more than one water quality limit exists for a water quality constituent or characteristic (e.g., human health limit vs. aquatic life limit), the more restrictive limit is used as

TABLE ES3-5

California Average Year Water Supplies by Hydrologic Region (with existing facilities and programs, in taf)

Region	1995				2020			
	Surface	*Groundwater*[a]	*Recycled & Desalted*	*Total (rounded)*	*Surface*	*Groundwater*[a]	*Recycled & Desalted*	*Total (rounded)*
North Coast	20,331	263	13	20,610	20,371	288	13	20,670
San Francisco Bay	7,011	68	35	7,110	7,067	72	37	7,180
Central Coast	318	1,045	18	1,380	368	1,041	42	1,450
South Coast	3,839	1,177	207	5,220	3,625	1,243	273	5,140
Sacramento River	11,881	2,672	0	14,550	12,196	2,636	0	14,830
San Joaquin River	8,562	2,195	0	10,760	8,458	2,295	0	10,750
Tulare Lake	7,888	4,340	0	12,230	7,791	4,386	0	12,180
North Lahontan	777	157	8	940	759	183	8	950
South Lahontan	322	239	27	590	437	248	27	710
Colorado River	4,154	337	15	4,510	3,920	285	15	4,220
Total (rounded)	**65,090**	**12,490**	**320**	**77,900**	**64,990**	**12,680**	**410**	**78,080**

[a] Excludes groundwater overdraft.

TABLE ES3-6

California Drought Year Water Supplies by Hydrologic Region (with existing facilities and programs, in taf)

Region	1995				2020			
	Surface	*Groundwater*[a]	*Recycled & Desalted*	*Total (rounded)*	*Surface*	*Groundwater*[a]	*Recycled & Desalted*	*Total (rounded)*
North Coast	10,183	294	14	10,490	10,212	321	14	10,550
San Francisco Bay	5,285	92	35	5,410	5,417	89	37	5,540
Central Coast	160	1,142	26	1,330	180	1,159	42	1,380
South Coast	3,196	1,371	207	4,780	3,130	1,462	273	4,870
Sacramento River	10,022	3,218	0	13,240	10,012	3,281	0	13,290
San Joaquin River	6,043	2,900	0	8,940	5,986	2,912	0	8,900
Tulare Lake	3,693	5,970	0	9,660	3,593	5,999	0	9,590
North Lahontan	557	187	8	750	557	208	8	770
South Lahontan	259	273	27	560	326	296	27	650
Colorado River	4,128	337	15	4,480	3,909	284	15	4,210
Total (rounded)	**43,530**	**15,780**	**330**	**59,640**	**43,320**	**16,010**	**420**	**59,750**

[a] Excludes groundwater overdraft.

the water quality objective.

Drinking water standards for a total of 81 individual drinking water constituents are in place under the mandates of the 1986 SDWA amendments. By the new SDWA standard setting process established in the 1996 amendments, EPA will select at least five new candidate constituents to be considered for regulation every five years. Selection of the new constituents for regulation must be geared toward contaminants posing the greatest health risks.

Occasionally, drinking water regulatory goals may conflict. For example, concern over pathogens such as *Cryptosporidium* spurred a proposed rule requiring more rigorous disinfection. At the same time, there was considerable regulatory concern over trihalomethanes and other disinfection by-products resulting from disinfecting drinking water with chlorine. However, if disinfection is made more rigorous, disinfection by-product formation is increased. Poor quality source waters with elevated concentrations of organic precursors and bromides further complicate the problem of reliably meeting standards for disinfection while meeting standards for disinfection by-products. The regulatory community will have to balance the benefits and risks associated with pursuing the goals of efficient disinfection and reduced disinfection by-products.

EPA promulgated its Information Collection Rule in 1996 to obtain the data on the tradeoff posed by simultaneous control of disinfection by-products and pathogens in drinking water. The ICR requires all large public water systems to collect and report data on the occurrence of disinfection by-products and pathogens (including bacteria, viruses, *Giardia*, and *Cryptosporidium*) in drinking water over an 18-month period. With this information, an assessment of health risks due to the presence of disinfection by-products and pathogens in drinking water can be made. EPA can then determine the need to revise current drinking water filtration and disinfection requirements, and the need for more stringent regulations for disinfectants and disinfection by-products.

There has been growing concern over the potential human health threat of pathogens in groundwater. This concern stems from pathogens such as *Giardia*, *Cryptosporidium*, bacteria, and viruses being found in water taken from wells. The concern about pathogens in groundwater has led to regulatory discussions on disinfection requirements for groundwater. It is currently estimated that the Groundwater Disinfection Rule will be proposed sometime in 1999 and will become effective in 2002. The data obtained through the ICR will provide the necessary information to assess the extent and severity of risk.

The SDWA requires states to implement wellhead protection programs designed to prevent the contamination of groundwater supplying public drinking water wells. Wellhead protection programs rely heavily on local efforts to be effective, because communities have the primary access to information on potential contamination sources and can adopt locally-based measures to manage these potential contamination sources.

CCWD's Los Vaqueros Dam under construction. The reservoir does not provide new water supply, but provides terminal storage for CCWD's existing supply and improves service area water quality.